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A Review on Shear Force Demand in Column-Beam-Slab Connection in Seismic Zones

Priyanka Porwal[1], Kishar Patil[2]

[1]Research Scholar, Department of Civil Engineering, Sushila Devi Bansal College of Engineering, Indore
[2]Professor, Department of Civil Engineering, Sushila Devi Bansal College of Engineering, Indore

ABSTRACT

Nowadays, buildings are basically used for construction because it offers many advantages in terms of efficiency over traditional RC Frame architecture, allowing use of space, simpler formwork, architectural durability and overall small construction time. Beam-column connections were defined as being one of the eventually weaker elements of reinforced concrete moment resisting frames subjected to various seismic loading. Excellent knowledge of RC joint shear behavior seems to be essential because severe damage can trigger deterioration of total performance of RC beam-column connections or frames within a joint panel. The research will be performed with the program STAAD .PRO V8i. This review paper covers the brief review of behavior in multi-story buildings under seismic forces for traditional RC slab construction and to analysis the efficiency of these types of buildings. Each method of repair or strengthening is reviewed by the various researchers' in the literature review section. Methods for improving performance of older joints need to be studied.

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I. INTRODUCTION

Demand for real estate in urban areas is growing day by day; to neutralize this necessity in those urban areas only choice is erect growth. This kind of development places extra-lateral neutralization challenges for wind and earthquake loads. Maintenance of the slabs by beams and reinforcement of the beams by columns is standard practice in architecture and construction. This can be dubbed the construction of a beam slab. The contribution of slab in the beam- column joint was first considered in ACI 352-02. Beam-column- slab connection becomes problem when we talk about lateral load i.e. seismic load it becomes a critical problem.

Beam- Column- Slab Connection:

A beam- column- slab connection is the combination of joint and beam column, slab adjacent to the joint. And also a joint is defined as that portion of the column within the depth of the deepest beam which frames into the column. Beam slab connection consists of three types of connections. Types of connections of are Interior beam column slab connection; Exterior beam column slab connection and Corner beam column slab connection.

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Connection failure of the structure: The failure in connection can be caused due to excess tension (T) in reinforced bar which can lead to bond failure. Material failure (M) is also a important reason for the failure of connection in structure. And before plastic hinge formation (P), failure of shear in the beam is also an important factor.

From many literatures survey it was interpreted that the above cited beam- column- slab connection failure are depend on following parameter:

Table 1 Factor affecting connection failure

S. No.	T	M	P
1	Type of connection	Type of connection	Type of connection
2	Grade of material	Grade of material	Grade of material
3		Height of story building	
4		Width of bay	Width of bay
5	Size of column	Size of column	Size of column
6	Size of beam	Size of beam	Size of beam
7	Diameter of bar	Diameter of bar	
8	Lateral Loading	Lateral Loading	Lateral Loading

II. LITERATURE REVIEW

There are many researches in the field of Beam- Column- Slab connection get momentum from 1970's.Related to this areas lot of papers published in many conference and journals. The literature reviews on Beam- Column- Slab connection we will discuss in detail in this chapter.

(Ahmed *et al.*, 2014) experiments were carried out on two-dimensional column beam joint specimens with no base, no beam eccentricity and no plane beams. Pseudo-static cyclic lateral charging was applied. They describe loading effects on the joint response of reinforcement steel yield strength, concrete compressive strength, percentage of column and beam reinforcement, percentage of hoop's reinforcement, in the joint and aspect ratio.

(Engindeniz, Kahn and Zureick, 2005) An experimental investigation was performed on four beam-column-slab link specimens designed with pre-1970 RC reinforcement undergoing reverse cyclic bidirectional loading with CFRP composite retrofitting. They discover that carbon fiber-reinforced polymer provides a simple to implement means for improving shear strength and is very effective. They also conclude that pre-earthquake retrofitting is less powerful than post-earthquake retrofitting in achieving strong column and weak beam behavior.

(Balhar and Vyas, 2008) Through their paper the aim was to compare four beam-column-slab panels in four stories with drop and drop-free lateral load-resistant model. Using ETABS software, the gravity load + lateral load is subjected to a four-story structure, and each story has been exported to SAFE software for lateral punching effect analysis. In accordance with IS 456, the economic thickness of the slab with drop and without drop is favored at the start of the permissible punching shear criterion; Results revealed that it is better to slab the economic point of view with a drop offering. Shear stress punching is also shortened by taking drop at slab-column link.

(Phan, Lew and Johnson, 1988) author studied about Multistoried Frames With and Without Sear Walls was under Wind Loads. It is shown that as compared to the flat floor system, traditional beam assisted slab system, the column moments for flat floor system building with Shear walls have decreased by 69.17% & 58.2 per cent. The shear walls also help to reduce the axial force of the column even in the middle frame area. In the case of other building frames the axial force of the column is equally diminished when wind is working. The structure of floor can be further improved by also providing Shear walls against the lateral load. The drift becomes low, so reduction in the drift in this case is 65.77 percent.

(Huang *et al.*, 2015) Experimentally and analytically studied the ultimate strength behavior of sandwich shell steel-concrete steel (SCS). Two quasi-static pilot tests on composite shells of lightweight SCS sandwich, which are subject to patch load, are carried out. Composite shell failure mode is punching shear. Tests revealed that the shear resistance to punching relies on the punched frustum concrete and shear connectors monitor perimeter. Membrane action of the outer steel plates gives post-hardening strength. To explain the mechanism of force transfer and to predict the punching shear resistance of SCS sandwich composite, an analytical model is constructed based on the experimental failure process. Model testing indicates the projections are in strong consonance with the test results.

(Ali, 2014) In this paper joint core shear demand is found using STAAD-Pro and for this they framed low and midrise building for seismic zone V. Joint shear demand is calculated as per code ACI 352-02. They conclude that shear force demand also increases with increase in height of structure; there is also no impact on shear demand with change in bays and column size.

(Balhar and Vyas, 2008) In their paper comparative analysis of slab behavior in various circumstances and typical 20 story slab structures. By using ETABS software, traditional RC slab with column drop, traditional structure and slab structure with shear wall at different locations, two typical areas of zone III and zone V were analyzed Comparison of outcomes of all models in time and frequency state, lateral displacements, story shears and story drifts by plotting graphs. Through seismic loads, slab construction with shear wall arrangement and column drop is done exceptionally fine to minimize displacements and drifts with enhancement of building rigidity. For conventional R.C, this paper summarized an overview of the research.

(Phan, Lew and Johnson, 1988) In their paper, the collective effects of shear beam building with and without shear wall on high rise seismic behavior with different shear wall positions examined. In ETABS, 11 story models are produced for this purpose. A linear dynamic analysis (Response spectrum analysis) is performed in ETABs software to research the effect of different shear wall locations on high rise structure. It tests out seismic parameters like time span, base shear, story displacement and story drift.

III. CONCLUSION

The ultimate purpose of this review paper was to provide a deeper understanding of joint shear structural behavior for various types of RC beam-column connections that are subjected to seismic lateral charge. This initiative was accomplished by constructing a thorough experimental database, characterizing RC joint shear behavior, developing RC joint shear strength models and proposing complete RC joint shear behavior models. Following are the conclusions which can be drawn:

- An analytical study revealed that joint reinforcement with strengthened masonry units could lead to desirable ductile beam failures and decreased inter-story drifts; however, no experimental data can be found to validate their efficiency.
- Epoxy repair techniques have shown limited success in restoring the reinforcing bond, cracks filling and restoring shear strength in single-way joints, although some writers consider it ineffective and unreliable. The authors assume it will be equally difficult to inject epoxy into joints that are surrounded by floor members.
- The demand for shear forces increases with the increase in the number of floors, the height of floors, the width of bays and the increase in the depth of beams.

The above details clearly shows the requirement of increasing the performance of the joint due to shear force demand of critical beam-to-column joints for making it suitable for the effect of wind load and earthquake load on the performance of building.

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